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Psychological Monographs: General and Applied

A Factor Analysis Study of Human Interests¹

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THE purpose of this investigation was to derive by means of comprehensive factor analysis a knowledge of basic interest dimensions, dimensions representing sources of human satisfaction. For the purposes of this study, an interest is defined as *a generalized behavior tendency an individual has to be attracted to a certain class of incentives or activities*. This conception is sufficiently broad to include negative attractions (aversions) as well as positive ones, which means that dimensions in the domain of interests can be bipolar.

The definition adopted indicates an obvious relation to motivation. This is as it should be. Published interest inventories and previous factor analyses have not paid sufficient attention to this relationship. Although previous analyses have frequently shown factors interpretable along the lines of vocational categories, it is quite possible that a more

thorough analysis would show that these can, in turn, be expressed as linear combinations of variables more obviously in the form of underlying motives. This possibility is comprehensively explored in this investigation. The variables analyzed include both those referring directly to activities of a vocational nature and those having broad meanings that transcend vocations.

The most widely used instrument in the general area of human motivation is the interest inventory, which requires verbal responses to verbal items. This kind of instrument has limitations as a selective device, but selection can be considered as a separate problem. There appears to be, at present, no means of assessing interests that is more dependable, more sensitive to individual differences, and more economical of time and effort than the verbal inventory. Administered under conditions that favor the full cooperation of the examinees, interest-inventory results can be relatively free of the biases introduced by self-imposed sets. They can serve as a means of exploring economically the domain of interests in a search for its unique dimensions, with the reservation that any factors thus found rest upon the examinees' views of their own specific likes, dislikes, and inclinations. The factors, like others, are subject to valida-

¹This investigation was done under Contract No. AF 33(038)18408 with the U. S. Air Force and was monitored by the Personnel Research Laboratory, Human Resources Research Center, Lackland Air Force Base, of the Air Research and Development Command. Permission is granted for reproduction, translation, publication, use, and disposal in whole and in part by or for the United States Government. A more complete account of the details of this research was published as *Research Bulletin 53-11* from the Human Resources Research Center. One of the analyses is described more fully in reference 32.

tion in terms of relations to information concerning interests derived by independent operations.

The general design of the study is to (a) develop primary hypotheses or make predictions of factors, (b) formulate subsidiary hypotheses that convert the primary hypotheses into operational terms,

(c) construct a ten-item test for each subsidiary hypothesis, (d) factor analyze the scores obtained, including rotation to psychologically meaningful, simple structure, and (e) interpret the obtained factors in relation to the hypotheses and tests.

I. DEVELOPMENT OF THE INSTRUMENT

HYPOTHESIS DEVELOPMENT²

The Nature of the Hypotheses

Hypotheses in this study served two purposes: (a) to provide a conceptual framework within which the results can be evaluated and (b) to provide specific and definitive areas within which to construct homogeneous groups of items.

The framework consists of 33 major hypotheses with (usually) several minor hypotheses subsumed under each. Each major hypothesis indicates an expected primary-interest dimension. Each sub-hypothesis reflects a specific feature or variation or alternative conception of the hypothesized primary-interest dimension, or represents some phenotypic index variable for that dimension. One hundred subhypotheses were formulated, and for each a collection of items designed for a single score was made. These scores represent the experimental variables to be factor analyzed.

Sources of Hypotheses

Several different avenues were explored as sources of hypotheses. Previous factor analyses and studies made with published inventories were important sources. Many general treatments of human motivation contain lists of inter-

ests, needs, drives, and other motivational determinants which were considered as possible hypotheses (5, 7, 24, 26, 33, 38). Such published material was supplemented by field interviews with airmen with diverse job assignments.

An important objective during the hypothesis formation phase was to achieve a rather broad coverage of human motivation. For this reason many motivational variables not obviously associated with recognized interests were included in the list of possibilities. Several different manifestations of motivation, such as needs, drives, attitudes, character traits, and temperament traits, as well as interests, were also considered. For reasons that should be rather obvious, the so-called animal drives were not included.

The List of Hypotheses

The hypotheses are listed in Table 1 by name and number. The 33 primary hypotheses are designated by Roman numerals and the 100 subhypotheses (or test variables) by Arabic numerals. In three instances it was not feasible to provide more than one supporting variable, nor could the variable be fitted under some other primary hypothesis. In such cases, then, a primary hypothesis is represented by only one set of items. In the factor analysis, such variables had

² John R. Hills contributed to the development of hypotheses and the writing of items.

TABLE 1
LIST OF HYPOTHESES AND TESTS

I. ADVENTURE	XVII. MATERIAL NEEDS
1. Exploration	52. Acquisition*
2. Harm-avoidance	53. Maintenance*
3. Monotony	XVIII. MECHANICAL ACTIVITY
4. Risk-Taking—Material	54. Construction
5. Risk-Taking—Personal	55. Design
6. Variety	56. Manipulation
II. AESTHETIC APPRECIATION	57. Repair*
7. Drama	XIX. OFFICE ACTIVITY
8. Graphic Arts	58. Clerical Work
9. Literature	59. Number Manipulation
10. Music	XX. ORDERLINESS
11. Nature	60. Disorderliness
III. AESTHETIC EXPRESSION	61. Orderliness, Personal
12. Drama	62. Orderliness, Surroundings
13. Graphic Arts	XXI. OUTDOOR ACTIVITY
14. Literature	63. Agriculture
15. Music	64. Travel
IV. AGGRESSION	65. Work
16. Direct Aggression	XXII. PERSISTENCE
17. Displaced Aggression	66. With Closure
V. ALTRUISM	67. Without Closure
18. Health and Healing	XXIII. PERSONAL ASSURANCE
19. Personal Services	68. Conscience Satisfaction
20. Welfare of Others	69. Immediacy
VI. ASPIRATION LEVEL	XXIV. PHYSICAL ACTIVITY
21. Aspiration Level	70. Athletics
VII. ATTENTION	71. Sedentariness
22. Approval	73. Vitality
23. Exhibition	XXV. PRECISION
24. Obscurity*	74. Carefulness
25. Recognition	75. Detail
26. Status	76. Exactness
VIII. BUSINESS	XXVI. RESPONSIBILITY
27. Administration	77. Dependability
28. Contact	78. Independence
29. Selling	79. Initiative
IX. CIVICS	80. Self-reliance
30. Civics	XXVII. SCIENCE
X. COMPETITION	81. Investigation
31. Competition	82. Laboratory
XI. CONFORMITY	83. Theory
32. Conformity	XXVIII. SENSORY SATISFACTION
33. Nonconformity	84. Appeals, Common
XII. CONTROL OF OTHERS	85. Appeals, Uncommon
34. Coercion	86. Cleanliness
35. Dominance	87. Comfort
36. Maintenance of Discipline	XXIX. SOCIAL SCIENCE
37. Persuasion	88. Social Science
38. Subservience	XXX. SUPPORT
XIII. DIVERSION	89. Affection
39. Amusement	90. Dependence
40. Autistic Thinking	91. Succorance
41. No-Nonsense	XXXI. SYSTEM
42. Play	92. Aversion to Organizing
43. Realism	93. Economy
44. Romanticism	94. Organizing
XIV. GREGARIOUSNESS	95. Structure
45. Affiliation	XXXII. THINKING
46. Making Friends	96. Logical Processes
47. Sociability*	97. Mathematical Concepts
XV. HUMOR	98. Problem Solving
48. Appreciation	XXXIII. VERBAL EXPRESSION
49. Expression	99. Development
XVI. MANUAL ACTIVITY	100. Elucidation
50. Construction	
51. Manipulation	

* Test of this was deleted before factor extractions for reasons mentioned later.

some chance of either attracting to themselves enough other measured variables to define a common factor or of being submerged in some other factor list. Statements of definitions of all the hypotheses are not provided here, since a comprehensive treatment of this kind is given elsewhere. (See footnote 1.)

ITEM DEVELOPMENT

Item Construction

Insofar as possible, an item was designed to represent only one subhypothesis, and the several items under a subhypothesis were to be highly intercorrelated. These conditions, even though imperfectly achieved, should reduce correlations between tests not primarily measuring the same factor, and at the same time maintain or enhance correlations between measures of the same factors. In addition, factors obtained from homogeneous subtests should be easier to interpret and to define than factors based on complex items or subtests (11).

The items were all of the multiple-choice type, with alternative responses of "Yes," "?," and "No." Although this type of item is open to response biases, i.e., favoring one or another response to some degree by certain individuals, it was believed to be much preferable to the forced-choice type of item for factor analysis purposes by the *R* technique. The forced-choice item, while tending to counteract the response biases, leads to a more serious error in scores. Since one interest variable is pitted against another in the usual forced-choice interest item, making a high score in one variable automatically entails lowering scores in one or more of the others.

Brevity, simplicity, and low word diffi-

culty were important guides in item writing. Negatively phrased items were generally avoided. Attempts were made to construct items that would yield approximately equal proportions of "Yes" and "No" responses and almost no "?" responses. Items requiring special knowledge or involving controversial ethical or religious issues were avoided.

Sources of Items

Most of the items were newly constructed to accord with the hypothesis definitions. Some were selected from published inventories or previous research studies and modified to suit our purposes better.

Types of Items

The items may be classified in three general types:

1. *Activity items:* The examinee states whether or not he would like to participate in a specific activity. Examples: "hunt elk in Wyoming," "build a brick wall," and "operate a bulldozer."
2. *Self-descriptive items:* The examinee agrees or disagrees with such statements as "You avoid rough or dangerous games" or "You are usually one of the quiet ones when in a group."
3. *Attitude and belief items:* The examinee approves or disapproves such suggestions as "Woman's place is only in the home" or "Children should be firmly disciplined when they disobey their parents."

Projective Items

Wherever it was appropriate and possible to do so, we made use of a type of item that can properly be called projective. Projective items probably depend for their success upon the same psychological mechanisms that make projective tests so popular, without the faults of a completely unstructured test situation. If we ask a person "Are you painstaking about your work?" he is likely to say "Yes," whether he is actually

painstaking or not, if he wants to make a good impression, perhaps without regard for the truth. If, however, we ask "Do you admire people who are painstaking about their work?" he can readily say "No," without necessarily realizing that he has revealed something about himself. The proof of whether the item discriminates as it was intended to do, of course, depends upon its correlation with other items intended to make a similar discrimination. To take another example, few people might be willing to say that they have habits of disorderliness, but many of them would be willing to say that they "often feel that some people are just *too* orderly," or that they "can relax better in a room that is in some disorder," or that they do not believe that "A neat office is the surest sign of a successful organization." In such ways one can make more attractive certain responses that would otherwise be unattractive or make less attractive responses that are socially popular. The difference can be seen in the proportions who give the keyed answers.

PRELIMINARY TESTING

The Pretest Inventories

The major purpose of the pretesting was to determine both the degree of homogeneity achieved in each score variable and the popularity level of each item. These item properties have a bearing upon reliability and upon the form of total-score distribution. We wished to avoid seriously skewed and possibly truncated distributions. Eighty-nine tests of 15 items each were pretested.

Pretest Samples

The pretest samples included several hundred male basic airmen in training

at Lackland Air Force Base.³ After elimination of unusable answer sheets, others were removed at random to reduce the number to 400.

Item Analysis

For the extreme quarters of the score distribution of each variable, counts were made of the "Yes," "?," and "No" responses. The proportion giving the keyed response in the two extreme groups combined gave the index of popularity. A point-biserial, item-total correlation was estimated, with correction for part-whole spuriousness, by procedures described elsewhere (12, 25). The latter correction is very important in tests as short as this. These item-remainder correlations were used to estimate (very roughly) the reliability to be expected of a total score from the 10 selected items, by a formula given elsewhere (10, p. 494). These estimates served the purpose of deciding when to drop variables and when to revise items.

PREPARATION OF THE FACTOR ANALYSIS INVENTORY

Selection of the Tests

The factor analysis battery was to consist of 100 scorable parts of 10 items each. Of the 89 pretested variables, two (MATERIAL NEEDS—Acquisition and Maintenance) were eliminated because of unsatisfactory item statistics. Thirteen of the tests in the final battery were not pretested. Generally, variables that they represented had been established in previous factor analyses, and only minor adaptations were necessary in order to use them with Air Force populations.

³ All test administration involved in this study was carried out by the Personnel Research Laboratory of the Air Research and Development Command.

Composition of the Factor Analysis Instrument

After revisions, the 1,000 items were arranged in five booklets of 200 items each. Booklets 1 and 2 contained items of the type "You would like to . . .," while booklets 3, 4, and 5 contained statements calling for agreement or disagreement. The variables were spaced throughout the five booklets so that tests coming under a given primary hypothesis would be in separate booklets.⁴

Within any booklet, items for all 20 variables were spaced so that at least seven other items intervened between any two items from the same variable. These spacing procedures helped to ensure a variety of items in any one booklet and served to prevent examinees from recognizing serial patterns.

⁴ Exceptions to this rule occurred when a primary hypothesis had more than five alternative subhypotheses.

II. THE ANALYSIS

THE SAMPLES

Airmen

A total of 898 airmen took the factor analysis battery. Answer sheets of Negro airmen were removed in order to increase homogeneity of the population with respect to cultural background. Airmen with Technical Specialty Aptitude Indices below four were eliminated to help ensure adequate literacy. Six hundred answer sheets remained after these eliminations. By statistical analysis it was determined that the 600 airmen in the sample represented the larger white, male airman population very well with respect to age and education.

Officers

The officer-level sample was composed of three subgroups: (a) AFROTC graduates; (b) air cadets and student officers in flight training; and (c) officer candidates in OCS training. A total of 804 officer subjects took the factor analysis battery. Answer sheets of the WAF officer candidates were deleted to make the sample homogeneous with respect to sex. Officers older than 27 were eliminated to achieve greater homogeneity in age. The final sample totaled 720, including 257

AFROTC graduates, 187 air cadets and student officers, and 276 OCS candidates.

The three subgroups in this sample did not represent their populations quite so well as did the airmen, but the means for age and education differed only 0.3 to 1.7 years from better estimates of population means.

TREATMENT OF SCORES

Reliability

After total scores were obtained, each of the 100 score variables was split into two parallel halves, using item-analysis information insofar as it was available. A random sample of 200 airmen and a stratified random sample of 200 officer personnel were selected for reliability estimates, using the Rulon formula (10). The reliability estimates for the airmen and officer subjects were of very similar level, ranging from .37 to .93, with medians of approximately .72. (See footnote 6.)

Between-Group Differences

Significant age and education differences within the officer sample led us to examine differences in interest-variable

scores. Score distributions for the three groups were compared with respect to proportions of cases in each subgroup falling above the grand "median" of all three groups combined.⁵ Significant group deviations were found on more than half of the variables. It was accordingly decided that officer raw scores should be adjusted for between-group differences. The procedure for this is described below.

Conversion of Raw Scores to Dichotomized Scores

The score distributions for airmen and officers on each of the 100 variables were generally symmetrical, although otherwise there was much irregularity with respect to shape. While most of the distributions approach normality, many were U-shaped or rectangular and some were skewed and even truncated. The irregularity of shapes of the distributions was predictable from the (a) limited possible range of scores, 0 to 10; (b) selection of items to maximize item intercorrelations and moderate item popularity, steps, which when very successful, result in U-shaped distributions; and (c) (partially dependent upon a and b) unequal interval widths of raw-score scales.

Airmen scores for each variable were dichotomized around the division between integer scores closest to the median of the distribution. Because of the demonstrated lack of homogeneity of the officer sample, officer scores were dichotomized around the respective subgroup median scores instead of the grand median. This procedure provides an estimate of *average within-group correla-*

tions, eliminating or minimizing between-group differences. It assumes that the factor structure is essentially the same for the three groups in spite of differences in means.

CORRELATIONS

The score distributions having been dichotomized, tetrachoric coefficients were estimated by the cosine-pi formula.⁶ This formula gives unbiased estimates of that statistic when scores are dichotomized near the medians. It was assumed that the *population* distributions on the variables that the tests measure were normal.

Separate correlation matrices were obtained for the airman and officer samples. For the airmen, age and education were dichotomized and treated as variables, giving a 102 x 102 matrix. Because of restriction in range, age and education were not included in the officer correlation matrix.

Age and education were removed from the airman matrix prior to factor analysis, since correlations with inventory variables were generally very small. The same five inventory variables were eliminated from the airman and officer matrices for such reasons as obviously negligible common-factor variances and near duplication of the correlations of another variable. These eliminations left two 95 x 95 matrices for factoring.

⁵ To save printing costs, 22 pages of tables, including score statistics, the two correlation matrices, two centroid-factor matrices, and two rotated-factor matrices, have been deposited with the American Documentation Institute. Order Document 4180 from the ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington 25, D.C., remitting in advance \$1.75 for 35-mm. microfilm or \$2.50 for 6- by 8-in. photocopies. Make checks payable to Chief, Photoduplication Service, Library of Congress.

⁶ The term "median" is in quotation marks because the term actually refers to the integral score division nearest the median, here and in following discussion.

EXTRACTION OF CENTROID FACTORS⁷

Though there was general similarity between corresponding airman and officer intercorrelations, comparison of the two matrices indicated that there might be some differences in factor structure between the two samples. Using IBM equipment, 24 centroid factors were extracted from the airman correlation matrix and 23 from the officer matrix. Estimated communalities were used in the diagonal cells. The estimates of communality were based on the highest coefficients in the columns of the correlation matrix, on estimated reliabilities, and other information. The final residuals in the two matrices were distributed symmetrically and unimodally about zero, with none deviating more than .09 from zero.

ROTATION OF THE REFERENCE AXES

All rotations were carried out by means of the Zimmerman graphic, orthogonal method (40), with the exception that in the airman analysis a Landahl rotation (21) was first applied to the centroid matrix in the hope of facilitating subsequent graphic rotations. Subsequent experience in the rotational solution seemed to indicate that this step was of little value and perhaps even retarded progress.

The airman and officer rotations were done independently by two investigators.⁸ There were several reasons for this choice. One reason, which was regarded as scientifically important, was

that this provided the opportunity to do a verification study of common factors in the two solutions. The lack of tests of statistical significance for the identities of factors makes such studies somewhat unsatisfactory, but cross identifications of factors is at least intuitively satisfying. Another reason for the independent rotations was the lack of extremely high correlation between the two correlation matrices, which led us to expect some divergencies between factor structures in the two solutions.

The criteria for rotations were the goals of simple structure and psychological meaningfulness. The criterion of positive manifold was not given a great deal of weight, since it was expected that there would be some bipolar factors after rotations were completed. The extent to which simple structure was achieved is indicated roughly by the number of zero loadings (less than $\pm .10$) for each factor. Out of the 95 loadings for each factor, the number of zero loadings in the airman solution ranged from 35 to 68, and in the officer solution from 37 to 65.

The best description of the factorial structure in either population, under the conditions of our testing operations, would undoubtedly be oblique in some places. Orthogonal rotations were much preferred for several reasons. One was the general lack of confidence in the power of arbitrarily chosen test batteries to determine the correct amounts of correlation among the first-order factors. An important practical reason was that orthogonal factors are better adapted to describe tests, and the final practical goal in this investigation was to set up tests for factors. A less important practical reason is the efficiency of the Zimmerman method.

⁷ The factors were extracted by Norman W. Kettner, by an IBM procedure that he adapted to the centroid method.

⁸ By Marcella A. Sutton and Norman W. Kettner.

III. INTERPRETATION OF FACTORS

Of the 24 airman factors and the 23 officer factors, only one factor in each case proved to be a residual. The remaining factors are interpretable, though with unequal degrees of confidence. Factors that are identifiable across the two independently rotated solutions may be viewed with a relatively high degree of confidence.

The first 17 factors discussed in this section are common to the two analyses. The tests with significant (.30 or higher) positive loadings in either the airman or

the officer analysis (AFA and OFA, respectively) are listed in the order of average size. For bipolar factors a succeeding group of tests with significantly negative loadings is listed. An account of the six factors from the airman analysis only, followed by the five from the officer analysis only is presented after the discussion of the first 17 factors. Within each of the three groups of factors the order of presentation is the order of amount of variance accounted for by each factor.

Factor A. Mechanical Interest

	AFA	OFA
56. MECHANICAL ACTIVITY—Manipulation	.79*	.81*
54. MECHANICAL ACTIVITY—Construction	.76*	.77*
50. MANUAL ACTIVITY—Construction	.68*	.74*
51. MANUAL ACTIVITY—Manipulation	.72*	.68*
75. PRECISION—Detail	.52*	.64*
55. MECHANICAL ACTIVITY—Design	.53*	.59*
81. SCIENCE—Investigation	.32	.59*
63. OUTDOOR ACTIVITY—Agriculture	.42	.39
65. OUTDOOR ACTIVITY—Work	.33	.46*
82. SCIENCE—Laboratory	.22	.57*
76. PRECISION—Exactness	.19	.55*
83. SCIENCE—Theory	.19	.32
97. THINKING—Mathematical Concepts	.12	.33
5. ADVENTURE—Risk-Taking—Personal	.10	.32
71. PHYSICAL ACTIVITY—Sedentariness	-.40*	-.34
86. SENSORY SATISFACTION—Cleanliness	-.29	-.38
27. BUSINESS—Administration	-.05	-.36
79. RESPONSIBILITY—Initiative	-.01	-.34

* Indicates the test's highest loading in any factor.

This is the well-established mechanical-interest factor. The leading tests in both solutions contain items dealing with mechanical manipulation, construction, and design as well as those pertaining to working with apparatus, equipment, or tools. The highest loadings on

the negative side support the hypothesis that persons with expressed mechanical interest dislike physically sedentary activities and an emphasis on cleanliness.

Zachert's factor of interest in "clean-hands-vs.-dirty-hands" occupations (39) is in line with this bipolarity.

Factor B. Scientific Interest

	AFA	OFA
83. SCIENCE—Theory	.57*	.55*
81. SCIENCE—Investigation	.68*	.41
97. THINKING—Mathematical Concepts	.49	.55*
82. SCIENCE—Laboratory	.49	.34
96. THINKING—Logical Processes	.36	.46*
55. MECHANICAL ACTIVITY—Design	.40	.35
88. SOCIAL SCIENCE—Social Science	.34	.33
76. PRECISION—Exactness	.47	.29
75. PRECISION—Detail	.46	.29
66. PERSISTENCE—With Closure	.39	.30
93. SYSTEM—Economy	.24	.33*
98. THINKING—Problem Solving	.15	.36*
9. AESTHETIC APPRECIATION—Literature	.34	.16
10. AESTHETIC APPRECIATION—Music	.35	.04
8. AESTHETIC APPRECIATION—Graphic Arts	.31	.02

* Indicates the test's highest loading in any factor.

All of the SCIENCE variables are positively loaded in both solutions. The small loading in Social Science reflects the empirical investigation aspect of the items in that test. The presence of the three THINKING variables reflects the association of mathematics and logical thinking to theorizing in science. The presence of the PRECISION variables indicates that these populations strongly recognize these aspects of science. The

presence of tests 8, 9, and 10 in the list for airmen may indicate that their science-interest factor represents something more generally cultural than that for the officers.

This factor is similar to several interest-in-science factors obtained by other investigators (4, 8, 23, 31, 35). The present factor is more comprehensive in that a larger variety of activities and qualities is represented.

Factor C. Adventure vs. Security

	AFA	OFA
1. ADVENTURE—Exploration	.60*	.36*
5. ADVENTURE—Risk-Taking, Personal	.52*	.38*
64. OUTDOOR ACTIVITY—Travel	.59*	.22
11. AESTHETIC APPRECIATION—Nature	.25	.39*
4. ADVENTURE—Risk-Taking, Material	.38	.25
70. PHYSICAL ACTIVITY—Athletics	.24	.34
6. ADVENTURE—Variety	.32	.15
2. ADVENTURE—Harm-Avoidance	-.41*	-.59*
3. ADVENTURE—Monotony	-.43*	-.43*
95. SYSTEM—Structure	-.38	-.27
87. SENSORY SATISFACTION—Comfort	-.18	-.45*
71. PHYSICAL ACTIVITY—Sedentariness	-.21	-.38*
86. SENSORY SATISFACTION—Cleanliness	-.15	-.34
32. CONFORMITY—Conformity	-.02	-.39

* Indicates the test's highest loading in any factor.

This bipolar factor has a liking for exciting action at one pole and an avoidance of excitement or danger at the opposite pole. The two top loadings on

each pole are in ADVENTURE tests, and most other loadings are consistent with the adventure-security concept. The supplementary loadings broaden the

meaning of the factor into a vigorous, daring quest for adventure at the positive pole and a craving for comfort and security at the negative pole.

The factor is similar to a bipolar component obtained by Kelley (19), which

had pioneering, outdoor, and daring interests at one pole and routine, domestic, and orderly preference at the opposite pole. Also similar is the craving-for-excitement-and-adventure factor found by Gernes (9).

Factor D. Social Welfare

	AFA	OFA
20. ALTRUISM—Welfare of Others	.50*	.60*
100. VERBAL EXPRESSION—Elucidation	.47*	.45
19. ALTRUISM—Personal Services	.32	.55*
34. CONTROL OF OTHERS—Coercion	.46	.41*
30. CIVICS—Civics	.45	.39
35. CONTROL OF OTHERS—Dominance	.37	.47*
18. ALTRUISM—Health and Healing	.45*	.37*
28. BUSINESS—Contact	.31	.48
99. VERBAL EXPRESSION—Development	.44*	.29
88. SOCIAL SCIENCE—Social Science	.45*	.25
58. OFFICE ACTIVITY—Clerical Work	.11	.42*
94. SYSTEM—Organizing	.31	.42
12. AESTHETIC EXPRESSION—Drama	.16	.34
79. RESPONSIBILITY—Initiative	.30	.12
37. CONTROL OF OTHERS—Persuasion	.31	.06

* Indicates the test's highest loading in any factor.

Probably the most interesting thing about this factor is the appearance of the CONTROL-OF-OTHERS tests in the list, as well as the ALTRUISM tests. The factor thus involves both the recognition of needs of others and the desire to help them, with strong overtones of wanting to control them. A well-developed social conscience is suggested by the Civics and Social Science test

loadings. The VERBAL EXPRESSION tests have elements of assistance to others by means of explanation and clarification.

Social welfare factors have been reported by Strong (31), Gernes (9), and others (4, 23). Holley's "kindliness" factor (18) may be strongly related, and it has aspects of severity and discipline as well as benevolence.

Factor E. Aesthetic Appreciation

	AFA	OFA
9. AESTHETIC APPRECIATION—Literature	.58*	.60*
8. AESTHETIC APPRECIATION—Graphic Arts	.49*	.67*
7. AESTHETIC APPRECIATION—Drama	.47*	.60*
10. AESTHETIC APPRECIATION—Music	.39	.60*
13. AESTHETIC EXPRESSION—Graphic Arts	.25	.48*
14. AESTHETIC EXPRESSION—Literature	.23	.49*
15. AESTHETIC EXPRESSION—Music	.10	.48
12. AESTHETIC EXPRESSION—Dramatics	.30	.26
86. SENSORY SATISFACTION—Cleanliness	.31	.20
6. ADVENTURE—Variety	.18	.31
96. THINKING—Logical Processes	.09	.40
64. OUTDOOR ACTIVITY—Travel	.31	.14

* Indicates the test's highest loading in any factor.

18. ALTRUISM—Personal Services	.35	.04
45. GREGARIOUSNESS—Affiliation	.30	-.08
90. SUPPORT—Dependence	.30	-.04

Interest in and enjoyment of the graphic, literary, dramatic, and musical arts are the obvious characteristics of this factor. Only the variable Nature of the AESTHETIC APPRECIATION variables is absent from this list of tests. Nature has its major variance on factor

C, adventure vs. security.

Among earlier factors similar to E are Lurie's "aesthetic appreciation" (23), Gernes's consumer of art (9), and Brogden's "interest in the fine arts" (4), the latter being found in an analysis of the Allport-Vernon interest-values items (1).

Factor F. Cultural Conformity

	AFA	OFA
68. PERSONAL ASSURANCE—Conscience Satisfaction	.54*	.43*
32. CONFORMITY—Conformity	.62*	.34*
31. COMPETITION—Competition	.37*	.34*
30. CONTROL OF OTHERS—Maintenance of Discipline	.55*	.29*
41. DIVERSION—No-Nonsense	.45*	.28
74. PRECISION—Carefulness	.43*	.28*
62. ORDERLINESS—Orderliness, Surroundings	.47*	.15
61. ORDERLINESS—Orderliness, Personal	.41*	.20
43. DIVERSION—Realism	.21	.33*
95. SYSTEM—Structure	.47*	.02
67. PERSISTENCE—Without Closure	.30	.13
23. ATTENTION—Status	.32	.02
87. SENSORY SATISFACTION—Comfort	.31	.01

* Indicates the test's highest loading in any factor.

The three significantly loaded tests that are common to both solutions attach great importance to accepted cultural standards. Conscience Satisfaction and Conformity items are primarily concerned with the acceptability and worthiness of one's behavior according to prevailing norms. The Competition scores also reflect culturally approved drives. Most of the loadings significant in the airman solution but not in the officer solution are interpretable along the same lines. The pattern is one of diligence, order, and careful application to the task at hand, with moderate rejection of

play and amusement. Perhaps it is significant that the officer population lays less ethical stress on such qualities as orderliness, persistence, and precision.

Factor F resembles somewhat the "conservatism" pole of the radicalism vs. conservatism attitude factor that several investigators have reported. A corresponding unipolar factor is Holley's "conventionalism" which was defined by scores on tests of conformity, competition, and morality (18). Other factors of similar interpretation are Barnes's "conformity" (2) and Whisler's "acceptance of conventional ethical principles" (37).

Factor G. Self-reliance vs. Dependence

	AFA	OFA
77. RESPONSIBILITY—Dependability	.55*	.30*
80. RESPONSIBILITY—Self-reliance	.31	.37*

72. PHYSICAL ACTIVITY—Tempo	.35	.06
21. ASPIRATION LEVEL—Aspiration Level	.31	.04
22. ATTENTION—Approval	-.34	-.54*
90. SUPPORT—Dependence	-.41*	-.41*
38. CONTROL OF OTHERS—Subservience	-.50*	-.32*
91. SUPPORT—Succorance	-.33*	-.39*
92. SYSTEM—Aversion to Organizing	-.45	-.29
87. SENSORY SATISFACTION—Comfort	-.28	-.43
60. ORDERLINESS—Disorderliness	-.53*	-.03
3. ADVENTURE—Monotony	-.21	-.30
69. PERSONAL ASSURANCE—Immediacy	-.06	-.35

* Indicates the test's highest loading in any factor.

The positive end of this bipolar axis is defined by the Dependability and Self-reliance tests in which the items describe responsible assumption of obligations and dependence on one's own abilities and resourcefulness. The negative pole suggests reliance on others for personal aid, comfort, and protection.

Barnes's factor of "independent self-sufficiency" (2) is similar to the positive pole of factor G, as are Gernes's leadership factor (9) and Stott's "independence" (29), and possibly various traits of character integration and maturity (3, 5, 37).

Factor H. Aesthetic Expression

	AFA	OFA
15. AESTHETIC EXPRESSION—Music	.54*	.52*
14. AESTHETIC EXPRESSION—Literature	.56*	.48
12. AESTHETIC EXPRESSION—Drama	.38*	.48*
13. AESTHETIC EXPRESSION—Graphic Arts	.46*	.36
99. VERBAL EXPRESSION—Development	.33	.34
49. HUMOR—Expression	.17	.55*
100. VERBAL EXPRESSION—Elucidation	.32	.25
10. AESTHETIC APPRECIATION—Music	.43*	.13
7. AESTHETIC APPRECIATION—Drama	.31	.16
18. ALTRUISM—Health and Healing	.30	.12

* Indicates the test's highest loading in any factor.

All of the four AESTHETIC EXPRESSION variables are at the head of the list for this factor, which represents interest in *performing* in the musical, literary, dramatic, and graphic arts. The VERBAL EXPRESSION tests have just enough implication of artistic expression to get into this list. The test Development includes items on writing commercials for radio and advertising circulars. The expression of humor appeals to the officer group as being an aesthetic matter but not to the airman group.

While both analyses bear out the hypothesis that appreciative interests are separable from expressive interests in aesthetics (factors E and H), the evidence indicates that the factors are not independent. There are some Aesthetic expression variables in the list for factor E and some Aesthetic Appreciation variables in the list for factor H. Of course, one might expect desire to express in artistic modes to be accompanied by appreciation of artistic productions; but appreciation may well not be accom-

panied by desire to express one's self.

The producer-of-art factor found in the Gernes analysis is similar to factor H in that it includes correlations with

preferences for being a composer, musician, interior decorator, and dramatist (9).

Factor I. Clerical Interest

	AFA	OFA
59. OFFICE ACTIVITY—Number Manipulation	.67*	.65*
58. OFFICE ACTIVITY—Clerical Work	.61*	.34
97. THINKING—Mathematical Concepts	.30	.52
28. BUSINESS—Contacts	.47	.15
27. BUSINESS—Administration	.47*	.24
75. PRECISION—Detail	.18	.32
71. PHYSICAL ACTIVITY—Sedentariness	.31	.13
76. PRECISION—Exactness	.13	.30
3. ADVENTURE—Monotony	.34	-.09

* Indicates the test's highest loading in any factor.

Considering the order in which the first three tests appear in the list, the outstanding feature of this factor is the liking for clerical type tasks, including number manipulation and the understanding of mathematical concepts. There appears to be a common ground of interest in bookkeeping and routine calculation tasks and the more complex mathematical treatments implied in the Mathematical Concepts test, perhaps because many examinees equate calculation with mathematics. If the two analyses are

viewed separately, an interest in working in a general business atmosphere with emphasis on monotonous routine, would be the direction the airman interpretation would take. Interest in activities requiring precision supplements the definition for the factor in the officer analysis.

Precedents for a clerical-interest factor are found in Gernes' clerical-interest factor (9) and Gundlach and Gerum's similar factor (17).

Factor J. Diversion, Need for

	AFA	OFA
42. DIVERSION—Play	.54*	.56*
39. DIVERSION—Amusement	.50*	.47*
44. DIVERSION—Romanticism	.52*	.45*
70. PHYSICAL ACTIVITY—Athletics	.44*	.32
98. THINKING—Problem Solving	.52*	.29
89. SUPPORT—Affection	.17	.36*
12. AESTHETIC EXPRESSION—Drama	.18	.30

* Indicates the test's highest loading in any factor.

Both factors J and K appear to carry a need to escape from the routine aspects of daily living and to indulge in less serious activities. There are, however, sensible differences between these two factors. The three diversion tests that lead to factor J involve a general ele-

ment of normal entertainment—participant activities such as playing with pets as well as spectator activities such as going to movies. The picture, when filled out by the PHYSICAL ACTIVITY—Athletics category, is one of recreation or healthy diversion. The fifth test in the

list, Problem Solving, appears here probably because of the recreational value of items such as solving riddles and puzzles and playing chess, checkers, and bridge. It was hypothesized that in the Problem Solving test "systematic thinking" would be most important. This was not true for the airmen. Perhaps the most noteworthy fact concerning factor J is that while the

activities involved are diversionary, they are popularly regarded as being self-improving, body-building, or broadening in mind and experience.

Only one earlier analysis revealed a clearly parallel factor, Gernes's (9), who found a factor that could be called diversion.

Factor K. Autistic Thinking

	AFA	OFA
48. HUMOR—Appreciation	.74*	.35*
40. DIVERSION—Autistic Thinking	.56*	.47*
17. AGGRESSION—Displaced Aggression	.55*	.49
39. DIVERSION—Amusement	.35	.33
34. CONTROL OF OTHERS—Coercion	.14	.37
49. HUMOR—Expression	.34	-.11

* Indicates the test's highest loading in any factor.

The variables in this list seem to involve something more than or different from simple diversion. These tests tend to have in common the implication of satisfactions that are gained vicariously. In all four of the major tests, but notably tests 40 and 17, a current of hostility reaction that avoids danger of retaliation is detectable. It may be that the purely amusing aspects of humor as represented by test 48 are only incidental. The "sudden-glory" aspect of humor items, however, fits well with the fantasy route to power, fame, and fortune represented in the test Autistic Thinking. In general, active or direct methods of achieving desired ends are bypassed for "Think about what you might have said in situations you were in" (test 40), "Watch circus clowns" (test 48), "See a

person you dislike get stopped by a traffic cop" (test 17), and "Watch wrestling matches regularly and frequently" (test 39). Amusement, test 39, appears in the list for both J and K, suggesting that amusing activities such as seeing burlesque shows and watching animals at the zoo can serve either as ordinary diversion or as an indirect means of realization of riskless and effortless superiority.

There is no clear parallel for this factor in previous analyses, except for factors emphasizing daydreaming, as found by Layman (22). The absence of a daydreaming inventory in the present investigation prevents definite identification of the two factors, also the absence of hostility aspects in the factor found by Layman.

Factor L. Attention, Need for

	AFA	OFA
25. ATTENTION—Recognition	.54*	.54*
26. ATTENTION—Status	.49*	.48*
23. ATTENTION—Exhibition	.36*	.45*
40. DIVERSION—Autistic Thinking	.29	.43

* Indicates the test's highest loading in any factor.

69. PERSONAL ASSURANCE—Immediacy	.18	.51*
35. CONTROL OF OTHERS—Dominance	.43*	.11
22. ATTENTION—Approval	.13	.38
17. AGGRESSION—Displaced Aggression	.18	.32
84. SENSORY SATISFACTION—Appeals, Common	.31*	.15
50. CIVICS—Civics	.31	.04

Three ATTENTION tests are significantly loaded in both solutions. The major common element is the desire to be in the limelight. There is an interesting order of these loadings in both rotations. If the order is significant, the indication is that the need for attention is best satisfied by real personal achievement where the *results* rather than the *person* cause esteem, but other means of provoking notice can serve if the more genuine distinction is not available. The leading test, Recognition, involves recognition based on superior performance; next in order is the Status variable, whose items express attainment of standing or frame by reason of class membership or association; and last comes Exhibition, whose items describe nearly pure atten-

tion-getting behavior that is worthy or not. Most of the variables loaded significantly on only the officer solution are reasonable supplements to the need-for-attention designation but they imply also some craving for sympathy. Several Autistic Thinking items refer to identification with famous persons, and Immediacy items call for notice of one's immediate supervisor. Though Dominance items, which are loaded in the airman solution, have obvious features of leading others, such as "Tell others what to do in an emergency," there is also the appeal to the need for being the center of attention while such directions are being given.

The Gernes analysis revealed a similar factor of exhibitionism (9).

Factor M. Resistance to Restriction

	AFA	OFA
33. CONFORMITY—Nonconformity	.56*	.58*
92. SYSTEM—Aversion to Organizing	.46*	.51*
60. ORDERLINESS—Disorderliness	.30*	.48*
78. RESPONSIBILITY—Independence	.34*	.44*
5. ADVENTURE—Risk-Taking, Personal	.34	.16
94. SYSTEM—Organizing	-.06	-.30*

* Indicates the test's highest loading in any factor.

Interestingly enough, this factor brings together negatively poled tests from several primary hypotheses. The loadings indicate a general impatience with a structured, orderly life and a strong desire for freedom in personal and work habits. On this interpretation, Independence items such as "You hate to be ordered around," are consistent with items of Nonconformity, Aversion to Organizing, and Disorderliness, such as

"Society places too many restraints on the individual," "You dislike following a schedule," and "You often feel that some people are just *too* orderly," respectively.

In some respects this factor might logically be expected to be bipolar to factor F, cultural conformity. A possible explanation for the lack of bipolarity to F is that the latter is ethically oriented, while factor M is primarily a matter of

personal habit preferences without much "flexible ascendance" (2) and Whisler's of an ethical component. "independence" (37).

Similar factors have been Barnes's

Factor N. Business Interest

	AFA	OFA
27. BUSINESS—Administration	.43	.60*
29. BUSINESS—Selling	.43*	.50*
28. BUSINESS—Contact	.48*	.50*
99. VERBAL EXPRESSION—Development	.30	.29
88. SOCIAL SCIENCE—Social Science	.20	.32
86. SENSORY SATISFACTION—Cleanliness	.32	.05

* Indicates the test's highest loading in any factor.

The BUSINESS tests provide a compelling factor here, since they stand out similarly from others in the list. Apparently the essential feature involves working with other people in a commercial atmosphere. The VERBAL EXPRESSION and SOCIAL SCIENCE loadings are undoubtedly due to the economic and commercial implications in these variables, with items such as "Devise convincing commercials for the radio," and

"Learn about the cause of depressions and inflations."

"Business" factors obtained from the Strong Interest Blank and Allport-Vernon Study of Values (3, 17, 23) are probably more general than the present factor, for in the present investigation a separate factor is reported for such types of activities as office work and computation.

Factor O. Outdoor-Work Interest

	AFA	OFA
63. OUTDOOR ACTIVITY—Agriculture	.67*	.57*
65. OUTDOOR ACTIVITY—Work	.75*	.43
50. MANUAL ACTIVITY—Construction	.38	.36
51. MANUAL ACTIVITY—Manipulation	.23	.37
11. AESTHETIC APPRECIATION—Nature	.30*	.11
85. SENSORY SATISFACTION—Appeals, Uncommon	.30*	.06

* Indicates the test's highest loading in any factor.

This factor clearly involves a liking for active, outdoor work such as farming, forestry, and construction. The MANUAL ACTIVITY loadings are appropriate since most outdoor work requires use of the hands, but most of this variance went to factor A, mechanical interest. The absence of the OUTDOOR ACTIVITY—Travel variable from the list suggests that merely being on the move is not strongly related to outdoor life.

Appreciation of nature is only slightly related to factor O, in the airman analysis only. SENSORY SATISFACTION—Appeals, Uncommon has its only significant loading on this factor in the airman rotation, probably indicating that those who enjoy outdoor work, with its rigors of unpleasant weather, are those who are rather impervious to other stimuli that are usually considered to be unpleasant.

Factor P. Physical Drive

	AFA	OFA
73. PHYSICAL ACTIVITY—Vitality	.48*	.46*
80. RESPONSIBILITY—Self-reliance	.40*	.30*
21. ASPIRATION LEVEL—Aspiration Level	.35*	.33
67. PERSISTENCE—Without Closure	.33	.31
72. PHYSICAL ACTIVITY—Tempo	.18	.53*

* Indicates the test's highest loading in any factor.

As grouped here, these tests describe a vital, self-reliant, hard-working person. He has relatively high goals and will put forth sustained effort and direct his considerable energy toward achieving those goals. Compared with factor U₀, ambition, found in the officer solution only, factor P is more like a temperament variable. It represents energetic, self-confident activity directed toward goals.

In factor U₀ there is not the reliance on hard work and perseverance but a preoccupation with social acceptance and a desire for recognition, status, and personal advancement.

Because of the coexistence of the tests Vitality and Tempo in the list, the factor is identifiable with the Guilfords' "general-drive" or "general-activity" factor (14).

Factor Q. Aggression

	AFA	OFA
16. AGGRESSION—Direct Aggression	.35	.52*
34. CONTROL OF OTHERS—Coercion	.50*	.36
17. AGGRESSION—Displaced Aggression	.27	.54*

* Indicates the test's highest loading in any factor.

Items in this group of tests connote a showing of hostility through such direct and indirect expressions or punitive and coercive actions as "You like to face your enemies and fight it out," "You would like to make a witness talk," and "You would like to watch a bully get beaten up." Test 34 appears to have two aspects, shown by its appearance here and also with factor D, social welfare, an aggressive or hostility aspect and a control

aspect.

This factor corresponds well with Barnes's "externalized aggression" (2), which has tests of overt aggression, sadism, biting, and defiant resentment in the lead. It also appears to be similar to Layman's "social aggressiveness" (22), which is called "hypomanic aggressiveness" by Cattell (5), and to Brogden's "hard-boiled aggressiveness" (3).

Factor R_a.⁹ Thinking

	AFA
97. THINKING—Mathematical Concepts	.52*
90. THINKING—Logical Processes	.50*
94. SYSTEM—Organizing	.46*

* Indicates the test's highest loading in any factor.

⁹ Factors R_a through X_a were found in the airman analysis only. This does not necessarily mean that these factors are lacking in the officer

personnel. A more likely interpretation is that some of the same score variables measure different factors, relatively, in the two populations.

98. THINKING—Problem Solving	.42
8. AESTHETIC APPRECIATION—Graphic Arts	.36
99. VERBAL EXPRESSION—Development	.36
13. AESTHETIC EXPRESSION—Graphic Arts	.32
59. OFFICE ACTIVITY—Number Manipulation	.31
43. DIVERSION—Realism	.30*

In contrast with factor K, autistic thinking, the thinking represented by this factor is analytical, realistic, and systematic. The three hypothesized THINKING variables are all moderately high on the list, identifying the factor as an interest in understanding and working with concepts and principles of mathematics and philosophy. The graphic tests in the list suggest that analytical thinking plays a role in the critical appreciation of graphic arts, an illustrative item (from test 8) being "Compare great paintings in terms of the different

schools of art they represent." Interest in logical thinking extends to liking to plan, organize, coordinate schedules (test 94), interpret facts to support a particular point of view (test 99), and even to a liking for efficiently and practically run government and school systems, and to a preference for articles on practical subjects over romantic stories (test 43).

Thinking is similar to a factor "liking for thinking" found by Guilford and Guilford (13).

Factor S_a. Expressiveness vs. Restraint

	AFA
49. HUMOR—Expression	.55*
4. ADVENTURE—Risk-Taking, Material	.52*
16. AGGRESSION—Direct Aggression	.37*
12. AESTHETIC EXPRESSION—Drama	.33
29. BUSINESS—Selling	.31
23. ATTENTION—Exhibition	.30
91. SUPPORT—Succorance	.30
67. PERSISTENCE—Without Closure	-.39*
77. RESPONSIBILITY—Dependability	-.35
2. ADVENTURE—Harm-Avoidance	-.34
74. PRECISION—Carefulness	-.32

* Indicates the test's highest loading in any factor.

Most of the test on the positive pole can be considered to involve the free expression of feelings. There is a characteristic freedom from restraint in the readiness to take a chance (test 4), and in responding directly with aggressive behavior (test 16). The wish to perform before others is reflected by tests of HUMOR—Expression, Drama, Selling, and Exhibition. Opposed to carefree expressiveness is a studied industrious-

ness characterized by care and restraint at the negative pole.

There is some similarity to "surgency" described by Cattell (5) as "carefree, impulsive, not over-conscientious." Vernon's "care-freeness" (36) can be related to the positive pole. Factor S_a is also identifiable with the Guilfords' rhythmia (13), described as "carefree and impulsive vs. conscientious and deliberate."

Factor T_a. Sociability

	AFA
46. GREGARIOUSNESS—Making Friends	.57*
79. RESPONSIBILITY—Initiative	.46*
89. SUPPORT—Affection	.43*
35. CONTROL OF OTHERS—Coercion	.40
19. ALTRUISM—Personal Services	.38*
20. ALTRUISM—Welfare of Others	.35
72. PHYSICAL ACTIVITY—Tempo	.35*
49. HUMOR—Expression	.32

* Indicates the test's highest loading in any factor.

The tests in this list have in common a friendly, active interest in people and a need for closeness and companionship. The items stress having friends, taking an active part in groups, and working with people rather than alone. It is

difficult to know with which of the several gregariousness and sociability factors previously found by Layman (22) and others to identify factor T_a. It may be a composite of two or more of such factors.

Factor U_a. Sympathetic Environment, Need for

	AFA
69. PERSONAL ASSURANCE—Immediacy	.59*
22. ATTENTION—Approval	.55*
87. SENSORY SATISFACTION—Comfort	.43*
37. CONTROL OF OTHERS—Persuasion	.42*
89. SUPPORT—Affection	.39
62. ORDERLINESS—Orderliness, Surroundings	.38
95. SYSTEM—Structure	.37
46. GREGARIOUSNESS—Making Friends	.30
86. SENSORY SATISFACTION—Cleanliness	.30

* Indicates the test's highest loading in any factor.

The items in the Immediacy, Approval, Comfort, and Affection test involve the need for a warm, sympathetic environment and understanding friends. Sample items from these variables are, respectively, "You feel hurt if people do not recognize how hard you are trying," "When you have something new, you want very much to have other people like it," "A comfortable place in which to work is the most important thing to you on a job," and "It is extremely important for you to feel that your family

and friends care for you." There is implication of avoidance of conflict and struggle, with a dependence on others for emotional support and encouragement. An ordered, routine pattern of life, as illustrated by Surroundings and Structure items, seems to be a reasonable accompaniment to the general meaning of this factor.

A precedent for this factor may be the Gernes (9) factor that can be called "sincerance."

Factor V_a. Precision

	AFA
76. PRECISION—Exactness	.65*
82. SCIENCE—Laboratory	.52*

* Indicates the test's highest loading in any factor.

75. PRECISION—Detail
59. OFFICE ACTIVITY—Number Manipulation

.38
.30

The common feature of these tests is an interest in doing detailed or exacting operations with precision instruments. This interest crosses several types of activities. It is a component of laboratory work, where careful handling and precise use of equipment are demanded. Typical Exactness items involve check-

ing the accuracy of clocks and inspecting aerial camera lenses.

This factor may be identifiable with the "meticulousness" factor found by Barnes (2), the "immaculateness" factor found by Holley (18), or the detail factor found by Gernes (9).

Factor W₈. Social Initiative

79. RESPONSIBILITY—Initiative
31. COMPETITION—Competition
45. GREGARIOUSNESS—Affiliation
72. PHYSICAL ACTIVITY—Tempo

AFA
.40
.35
.35*
.35*

* Indicates the test's highest loading in any factor.

The picture is that of a dynamic, competitive, yet socially oriented individual. Friendly socialized competition and social leadership may characterize the

factor. It may be identifiable with "ascendancy" factors previously found and with the resourcefulness factors found by Stott (30) and Gernes (9).

Factor R₉.¹⁰ Cultural Interest

30. CIVICS—Civics
99. VERBAL EXPRESSION—Development
100. VERBAL EXPRESSION—Elucidation
9. AESTHETIC APPRECIATION—Literature
88. SOCIAL SCIENCE—Social Science
7. AESTHETIC APPRECIATION—Drama
10. AESTHETIC APPRECIATION—Music
8. AESTHETIC APPRECIATION—Graphic Arts
14. AESTHETIC EXPRESSION—Literature

OFA
.51*
.51*
.48*
.44
.42*
.41
.41
.38
.38

* Indicates the test's highest loading in any factor.

This factor represents a fairly broad, informed-citizen interest in a wide assortment of cultural areas. The Civics and Social Science items are similar in their concern with general issues of geography, economics, and politics. Many VERBAL EXPRESSION items relate to purposive communication on such matters as "Send a letter to a newspaper explaining your views" and "Explain the

duties and responsibilities of a U. S. Senator." The AESTHETIC loadings show another facet of the desire to be familiar with a variety of cultural matters.

There are several points of similarity between this factor and Cattell's "general-education" or "cultured-mind" factor, which also involves wide intellectual and aesthetic sophistication. It also suggests Brogden's "culture-for-its own-sake" factor (4). Perhaps the appear-

¹⁰ Factors R₉ through W₈ were found in the officer analysis only. (See footnote 9.)

ance of a cultural-interest factor in the officer analysis but not in the airman analysis can be attributed to the difference in educational level between the

two groups. The variables concerned have more common cultural connotations for the better educated group.

Factor S₀. Orderliness vs. Disorderliness

	OFA
62. ORDERLINESS—Orderliness, Surroundings	.59*
61. ORDERLINESS—Orderliness, Personal	.58*
41. DIVERSION—No-Nonsense	.42*
86. SENSORY SATISFACTION—Cleanliness	.40*
95. SYSTEM—Structure	.37*
67. PERSISTENCE—Without Closure	.33*
60. ORDERLINESS—Disorderliness	— .34
4. ADVENTURE—Risk-Taking, Material	— .32*

* Indicates the test's highest loading in any factor.

Three ORDERLINESS variables alone provide the definition of this factor. At the one pole we have a preference for neat, clean, and systematic arrangement of effects and surroundings, while at the opposite pole we have a rejection of compulsive neatness and order. The tests No-Nonsense, Structure, and PERSISTENCE—Without Closure fill out the picture of strict adherence to a rigid, self-

controlled style of life. The negative projection on Risk-Taking, Material suggests a fear of losing order and of leaving too much to chance.

Orderliness vs. disorderliness is similar to previous factors such as Barnes's "meticulousness" (2), Holley's "immaculateness" (18), and Vernon's "scrupulousness" (36).

Factor T₀. Physical Fitness Interest

	OFA
70. PHYSICAL ACTIVITY—Athletics	.49*
35. CONTROL OF OTHERS—Dominance	.38
18. ALTRUISM—Health and Healing	.37*
25. ATTENTION—Recognition	.36
39. DIVERSION—Amusement	.36
48. HUMOR—Appreciation	.35*

* Indicates the test's highest loading in any factor.

Athletics and Health and Healing have their highest loadings on this factor, indicating an interest in vigorous, good health and physical well-being. Probably most of the nonstarred loadings can be explained by certain incidental item similarities in the various tests. For example, "Watch athletic teams practice," "Be a leader so as to get more recogni-

tion for your work," and "Put a group through its regular setting-up exercises" have obvious common elements, although these items are from Amusement, Recognition, and Dominance, respectively, and all bear relation to the Athletics item "You like to exercise with gym equipment."

Factor U₀. Ambition

	OFA
21. ASPIRATION LEVEL—Aspiration Level	.48*
79. RESPONSIBILITY—Initiative	.42*
25. ATTENTION—Recognition	.37
26. ATTENTION—Status	.35
64. OUTDOOR ACTIVITY—Travel	.31
37. CONTROL OF OTHERS—Persuasion	.30*

* Indicates the test's highest loading in any factor.

The factor seems to be one of ambition to advance socially and professionally, to be recognized and accepted as one of high status. Evidently it is felt that to travel extensively is to imply economic and cultural distinction. Competi-

tion for the satisfaction of competing apparently is not involved.

Factor U₀ may be close to Holley's "opportunism," with its leading test of prestige (18), but otherwise resembles that factor very little.

Factor V₀. Variety, Need for

	OFA
6. ADVENTURE—Variety	.47*
64. OUTDOOR ACTIVITY—Travel	.47*
19. ALTRUISM—Personal Services	.36
5. ADVENTURE—Risk-Taking, Personal	.32
11. AESTHETIC APPRECIATION—Nature	.30
93. SYSTEM—Economy	.30

* Indicates the test's highest loading in any factor.

The leading tests express a desire for new places and new experiences. To want to "Change your job about once a year," "Keep on the move," or "Go on the first rocket-ship expedition to the moon" indicates a general impatience with staying in one place and doing the same things. Such a tendency is also implicit in the Nature items, which involve observation

of varied scenery, including deserts, oceans, and mountains.

Although an earlier "variety-loving" factor was reported by Guilford and Guilford (14), the present factor has a larger number of variables to define the trait. Gernes also reported (9) a factor that can be called need for change.

IV. DISCUSSION

RELATION OF OBTAINED FACTORS
TO HYPOTHESES

The 33 original hypotheses were proposed as a fairly comprehensive set of dimensions within the domain of human motivation. The 100 tests were designed so that most of the primary hypotheses, especially those represented by three or more tests, could emerge as factors in the

rotational solution. Of the 33 primary hypotheses, however, after eliminations preceding the analysis, only 19 had three or more tests. Nine had two tests each and four had only one test each. Thus, only 19 expected factors had a good chance of emerging. The nine expected factors for which there were two tests each could emerge if the two tests cor-

related exceptionally high or if they gained support from other groups of tests. The four expected factors for which there was a single test would have little chance at all except with considerable assistance from tests in other groups.

Of the 19 primary hypotheses for which there were at least three tests, 14 may be said to have been verified by the finding of corresponding common factors. The identification of a factor with a hypothesis must be done more or less on an intuitive basis, since there are no rigorous procedures for accepting or rejecting such hypotheses. The 14 hypotheses that were verified, 11 on the basis of both analyses and 3 on the basis of one analysis only, are as follows:

Common Factor

- A Mechanical interest
- B Scientific interest
- C Adventure vs. security
- D Social welfare
- E Aesthetic appreciation
- H Aesthetic expression
- J Diversion, need for
- L Attention, need for
- N Business interest
- O Outdoor-work interest
- P Physical drive
- V_a Precision
- R_a Thinking
- S_a Orderliness vs. disorderliness

The hypotheses for which there were three or more tests but which were not verified are:

- XXI CONTROL OF OTHERS
- XXVI RESPONSIBILITY
- XXVIII SENSORY SATISFACTION
- XXX SUPPORT
- XXXI SYSTEM

It is of some interest to see what happened to the variance in tests designed to bring out five factors of these kinds. This matter will be discussed in some detail with the idea that it may be helpful to other investigators who explore the same

areas of personality. Some new, interesting affiliations are brought out.

In the area of CONTROL OF OTHERS there were five tests. Three of these (Coercion, Dominance, and Persuasion) came out with significant variances in the social-welfare-interest factor. This was true in both analyses for the first two tests. Other meaningful affiliations were between the score for Coercion and the aggression factor, between the score for Maintenance of Discipline and the cultural conformity factor, and between the score for Subservience and the dependency end of the self-reliance vs. dependence factor. The score for Dominance also showed relationship to two factors—need for attention and physical fitness interest. Usually, such unexpected affiliations can be accounted for by one or more items in the test that stray from the most prominent common element. Examples of this will be given later. The fate of the variance of the Persuasion score is of interest by virtue of the fact that Persuasion is scored in the Kuder Preference Record. Other significant variances in

Primary Hypothesis

- XVIII MECHANICAL
- XXVII SCIENCE
- I ADVENTURE
- V ALTRUISM
- II AESTHETIC APPRECIATION
- III AESTHETIC EXPRESSION
- XIII DIVERSION
- VII ATTENTION
- VIII BUSINESS
- XXI OUTDOOR ACTIVITY
- XXIV PHYSICAL ACTIVITY
- XXV PRECISION
- XXXII THINKING
- XX ORDERLINESS

our Persuasion score were in the factors of ambition and need for sympathetic environment. These affiliations could be rationalized.

The group of test variables under the hypothesis of RESPONSIBILITY were found by Stott (30) to yield at least three separate factors. In support of Stott's results, we find that they do not hang together to define a single factor here. There seems to be insufficient coherence among them in our analyses even to produce a composite factor, such as sometimes happens. Two of them (Dependability and Self-reliance) did have enough in common to come out together significantly on the factor named self-reliance vs. dependence, in both analyses. The score for Independence came out on the factor called resistance to restriction. Since the factor was defined also as "need for independence," this

affiliation is reasonable. In fact, the factor of resistance to restriction may be identical with Stott's independence factor, though it appears somewhat broader in scope. The score for Initiative went in three directions: toward the social welfare and sociability factors in the airman analysis and toward the negative pole of mechanical interest in the officer analysis. The first two affiliations seem reasonable. Just why those with high mechanical interests should show low interest in initiative is hard to explain.

The tests under the hypothesis of SENSORY SATISFACTION would seem to be homogeneous psychologically, but their variances went in different directions. Two of them, Sensory Appeals, Common and Sensory Appeals, Uncommon, had very low communalities. The former had only one significant loading and that was with the factor of need for attention. Perhaps an item that was concerned with receiving a leisurely massage had something to do with this affiliation, also other items, on "work with brightly colored materials" and being "an expert taster of fine foods." The score on uncommon appeals actually referred to sensory aversions for most people. The items referred to loud or high-pitched sounds, foul odors, and the like. The only significant loading was with the factor of outdoor-work interest. Those who like outdoor work must often be less particular than most people about unpleasant sensory stimulation.

It was expected that the score for Cleanliness would help to define a factor of meticulousness found by Barnes (2) and verified by Holley (18). Two factors in this study, orderliness vs. disorderliness in the officer analysis and the precision factor in the airman analysis, are possible candidates for identification with the meticulousness factor. The former had a significant loading in Cleanliness. Cleanliness also had significant loadings, however, in the factors of aesthetic appreciation, need for sympathetic environment, and business for the airmen, and negative loadings in the factors of adventure vs. security and mechanical interest for the officers. All of these are reasonable.

The score for Comfort had significant loadings for the factors of cultural conformity and need for sympathetic environment for the airmen and the factors adventure vs. security and self-reliance vs. dependence (with negative signs) for the officers.

There is about as much evidence that the hypothesis of SUPPORT was verified in the obtained factor of self-reliance vs. dependence as that the hypothesis of RESPONSIBILITY was verified by the same factor. The RESPONSIBILITY tests help to determine the positive pole of that factor and the two SUPPORT tests help to determine the negative pole. The test concerning need for affection did not go along with the tests Dependence and Succorance, however. Examination of the items for Affection shows that they refer to closeness to friends and members of the family without much implication of dependence on them.

It might well have been expected that the group of tests under the hypothesis of SYSTEM would either bring out a factor of their own or would have variances in the factor of orderliness vs. disorderliness. Neither outcome was completely fulfilled. The score for Aversion to Organizing had significant or near significant relationships to the negative pole of resistance to restrictions, in both analyses. That the dependent person has a general aversion to system (in the form of planning and schedules) has perhaps not been sufficiently realized. It is reasonable in this analysis when we know that two of the ten items for Aversion to System have to do with not crossing bridges until one comes to them and belief that "tomorrow will take care of itself." The score for Economy, which rested on items pertaining to saving time and energy as well as money, yielded significant loadings for the factors of scientific interest and need for variety in the officer analysis. The score for Organizing, which indicated liking for planning and scheduling, had significant loadings for social welfare and thinking in the airman analysis and a negative loading for resistance to restriction in the officer analysis, all of which are reasonable. The score for the test called Structure scattered its variance several ways—to cultural conformity, need for sympathetic environment, and to the negative pole of adventure vs. security in the airman analysis and to the factor of orderliness vs. disorderliness in the officer analysis, all of which are reasonable affiliations.

Of the nine hypotheses for which there were two tests each, four were verified, three in both analyses and one in the airman analysis only. They are:

Common Factor

- F Cultural conformity
- I Clerical interest
- Q Aggression
- T_s Sociability

Primary Hypothesis

- XI CONFORMITY
- XIX OFFICE ACTIVITY
- IV AGGRESSION
- XXV GREGARIOUSNESS

The five hypotheses in this group that were not verified are:

- XV HUMOR
- XVI MANUAL ACTIVITY
- XXII PERSISTENCE
- XXIII PERSONAL ASSURANCE
- XXXIII VERBAL EXPRESSION

For only two of these hypotheses were there precedents in the way of common factors. A factor of persistence has been mentioned (e.g., Thornton's plodding factor [34]) and a factor of interest in language or a verbal interest factor. The latter might lead one to expect a factor common to the tests under VERBAL EXPRESSION. There was the possibility, however, that these two variables might go into the aesthetic expression group, although the artistic aspects of writing were not emphasized in the items of these tests. Let us see where the variances of tests in these five groups went.

The score for HUMOR—Appreciation contributed variance mainly to the factor called autistic thinking in both analyses. This trait seems to entail deriving satisfaction from the achievement of felt superiority by effortless and indirect methods. The type of humor that is probably most appreciated by the person who ranks high in this factor is that involving "sudden glory," or that which plays up weaknesses of others. The test HUMOR—Expression also has a significant loading in the autistic thinking factor for airmen but not for officers. For officers the expression of humor has instead an aesthetic expression value. For the airmen the humor-expression score also relates to the factors of sociability and expressiveness vs. restraint. Thus, while the more intelligent officer personnel is apparently sensitive to the aesthetic aspects of producing humor, the relatively less intelligent airman is apparently relatively more aware of its role in social activity.

The scores for MANUAL ACTIVITY, having to do with either construction or manipulation, divide their variances between the factors of mechanical interest and outdoor-work interest in both analyses, the larger portion of the variance going to mechanical interest. This result is largely a result of the kind of MANUAL ACTIVITY items used. Whether it is possible to write items free from mechanical or outdoor implications in the manual activity area is questionable. It will require items of this sort to determine whether a separate factor of manual activity interest *per se* exists.

The two tests under the hypothesis of PERSISTENCE emphasized keeping on at tasks; in the one case tasks *with* completion or closure and in the other case tasks *without* completion or closure. PERSISTENCE with Closure had loadings of marginal significance in the factor of

scientific interest in both analyses. The picture of scientific interest which we obtain from this study, then, includes some of the element of drive for completion of tasks. The score for persistence without closure is related to the factor of physical drive for both airmen and officers, to cultural conformity and expressiveness vs. restraint for airmen, and to orderliness vs. disorderliness for officers. Most of these relationships are reasonable, but the question concerning a separate persistence factor remains. Such a factor has been found mainly in performance test scores rather than in inventory scores. It would seem that the factor should also be detectable in inventory scores. It will evidently require types of items other than those we used to bring it out.

The assumption of a factor of PERSONAL ASSURANCE had little precedent in factor-analytic research. If there is such a factor the two tests in this area failed to bring it out. The score for Conscience Satisfaction came out with significant variances in the factor cultural conformity and helped to emphasize the ethical aspect of that factor in both analyses. The score for Immediacy (knowing where one stands with others, need for being appreciated, etc.) relates to the factor of need for attention in the officer analysis and to the need for sympathetic environment in the airman analysis.

While the two tests under the hypothesis of VERBAL EXPRESSION may have been insufficient to bring out the factor of linguistic interest so often found before, there were other tests that should have helped. There was a test on Literature under the main hypothesis of AESTHETIC APPRECIATION. This had to do with the enjoyment of reading, libraries, and books. There was also a test on Literature under the main hypothesis of AESTHETIC EXPRESSION, having to do with the writing of literature of various kinds. The presence of these four tests in the battery, all having to do with verbal or linguistic activities, was favorable for the emergence of a linguistic or verbal-interest factor.

It cannot be said that the aesthetic factors, either appreciative or expressive, dominated the variance in the two VERBAL EXPRESSION tests, for those tests had higher loadings in other factors. These two tests had loadings of marginal significance for the factor of aesthetic expression in both analyses and insignificant loadings in the factor of aesthetic appreciation.

Because the Development test contained items that describe persuasive-writing activities, it might have helped to bring out a factor of persuasiveness along with the test designed for measuring the variable of the same name. This result did not occur, however. Instead, both the tests Development and Elucidation joined with

the test Persuasion in sharing variance in the factor of social welfare. The Elucidation test is clearly concerned with helping other individuals by explaining or giving information.

The score on Development also showed affiliation with the factor of cultural interest for the officer population and with the factor of interest in thinking for the airman population. The score for Elucidation also showed relationship to the factor of cultural interest for the officers. It may be that the more common college experience for the officer group tended to tie up argumentative and expository writing with education and hence with culture in the minds of members of that group.

Of the four primary hypotheses having only one test each, **ASPIRATION**, **CIVICS**, **COMPETITION**, and **SOCIAL SCIENCES**, one had a test that helped to determine a factor uniquely. That was the test of Aspiration Level, which led the list of tests defining a factor called ambition in the officer analysis. It was aided by several reasonable tests from other groups, including **RESPONSIBILITY**—Initiative, **ATTENTION**—Recognition, **ATTENTION**—Status, and to some extent **CONTROL OF OTHERS**—Persuasion. There is some logical basis for questioning whether ambition is a unitary factor, since there can be aspirations in different directions. The directions may, however, be accounted for by various interest factors, with the factor of ambition as a core of general desire for success. This general drive for success may find a number of possible expressions in the individual, depending upon the strengths of various interest factors. The ambition factor reported here may be a general *intensity-of-motivation* variable that cooperates with the dynamic effects of interests in more specific directions.

For both officer and airman populations the score on Civics had significant loadings in the factor of social welfare. The items emphasized public-spirited

participation in government and by implication, at least, betterment measures. There was some additional significant variance in the cultural-interest factor for the officer group, which, again, may reflect a tie-up with education. For the airman group the additional minimally significant variance was in the factor of need for attention. Some items pertained to actions that would bring some degree of distinction to the individual who engages in them.

For both officers and airmen the score for Competition had most of its significant variance in the factor of cultural conformity. While competition may present its unethical aspects and hence there may be some surprise at the appearance of this test in relation to a factor that has strong ethical leanings, it must be remembered that competitive ideals play an important role in our culture. Thus, the factor of cultural conformity means conventionality of rather broad generality. For the airmen, the Competition score also bears some relationship to their factor of social initiative, a fact that helps to give that factor its interpretation.

The test Social Sciences had small significant loadings in the scientific-interest factor in both analyses. As was pointed out in the discussion of that factor, the items in that test emphasized the empirical approach to discovering facts and principles in the social sciences; hence, to a small extent it goes along with the natural science variables. The test Social Science had some cultural-interest variance for the officer population, again, probably a consequence of associating the social sciences with the collegiate context. For the airmen the test had some variance in the social welfare factor instead. Among the items were references

to immigration, depressions, and population problems. The airmen may have tended to take a more practical view rather than an academic one of the items presented.

In evaluating the rationalizations presented concerning tests in relation to factors and factors in relation to hypotheses, the reader must keep in mind that they are predicated on particular rotational solutions. While it is believed that the rotational solutions are relatively unique, there is always room for questioning the validity of rotations in some places. We have allowed speculations to have their way, with the recognition that they are post hoc but that they should also serve as starting points for hypothesis formation underlying future research. Taken in this vein, the ideas set forth should at least stimulate further fruitful thinking and research.

THE STRUCTURE OF THE INTEREST DOMAIN

One of the questions with which we started was whether the obviously vocational interest factors that have been found will come through as unities when a sufficient number of more basic motivational variables are introduced into the analysis. The answer is very definitely that they will do so. Our results verified the well-known factors:

mechanical interest
scientific interest
social welfare interest
aesthetic expression interest
clerical interest
business interest

Only the linguistic or verbal-interest factor is missing from the well-established list of vocational-interest factors. Our analysis adds another factor to this list, though the sphere of vocational activity

represented is less sharply focused than is true of the six factors listed above. This is the outdoor-work-interest factor.

Not only (with the exception of the verbal-interest factor) did none of the vocational factors vanish, as could have been expected, but they tended, instead, to attract into their orbits variance that should perhaps have gone to nonvocational factors. There are several examples of this. The mechanical factor had substantial relationships to scores for interest in manual activities such as construction and manipulation and to interest in outdoor activities and manual labor, as well as to interest in precision (exact or detailed work). The scientific factor showed substantial relationships to interest in thinking activities (mathematical and logical), to interest in precision (exactness and detail), and to aesthetic appreciation in the fields of literature, music, and the graphic arts, at least in the airman population.

The factor of interest in social welfare showed a surprising relation to interest in controlling others as well as in helping others. There were strong loadings in measures of desire to coerce or to dominate others. Holley's analysis (18) had shown a similar affiliation. The social welfare factor was also substantially related to the scores for the urge for verbal expression in the form of elucidation and the writing of persuasive material.

The intercorrelations of scores are such as to assure the unitariness of vocational factors. The intercorrelations among the scores designed to measure one of these vocational factors were higher among themselves than they were with scores in the nonvocational-interest inventories. The vocational factors were thus able to maintain themselves. Such

correlations were found in spite of the fact that the selected variables under these vocational categories were presumably made different enough not to be regarded as representing the same specific factor. The four variables under the mechanical category were designated Construction, Design, Manipulation, and Repair. The score for Repair was found to be so highly correlated with the other three that it was suspected of lacking experimental independence and was discarded before the analysis. The three variables scored under the heading of SCIENCE were called Investigation, Laboratory, and Theory. Three tests under the hypothesis ALTRUISM were called Health and Healing, Welfare of Others, and Personal Service. These groups of items in each case were regarded as sufficiently disparate to avoid the suspicion of specific overlap.

The business and clerical factors showed much less tendency to gain satellites, though there was some. The business-interest factor was defined by three business-variable scores in both analyses, the variables being called Administration, Selling, and Contact. In both analyses there was a small relation of the factor with the score for verbal expression in the Development test, which dealt with persuasive writing. The clerical-interest factor was determined most strongly by scores for interest in Number Manipulation and Clerical Work. There were also relationships to the scores for interest in mathematical thinking and precision (both detail and exactness).

The results support well the belief in vocational-interest factors as genuine psychological unities. Our social culture (and no doubt this is true of other cultures) has established firmly in the minds

of men the vocational stereotypes represented. The degree of precision of the stereotype varies from one factor to another, as the class of occupations and tasks involved represents a more or less coherent or restricted picture. It is also apparent that each stereotype of an occupational or job class bears some consistent relationships to more generalized interest factors, and to some extent the vocational factors show relationships to one another, as between mechanical and scientific interests and between business and clerical interests.

The structure of the interest domain, then, can be conceived as having a large number of basic, generalized dimensions that cut across many vocational lines, superimposed upon which are a few social stereotypes of broad job families whose existence as unities rests upon knowledge of vocations. This knowledge of vocations includes prominently the awareness of social goals and also combinations of aptitudes needed for these vocations. This knowledge is, of course, generally naive. One way in which knowledge of aptitudes plays a role may be as follows. A person who possesses in higher-than-average degree combinations of abilities that enable him to surpass in mechanical tasks derives satisfaction in doing those things. He is rewarded and hence by reinforcement an interest develops.

Readers who are interested in factor analysis as a technique will find something illuminating in the effect that the presence of some of the vocational-interest factors seemed to have on the results elsewhere in the total structure. A factor of interest in precision appeared only in the airman population. While the two PRECISION scores had loadings in the mechanical, scientific, and clerical factors

in both solutions, these loadings were on the whole stronger in the officer analysis. Thus, strong vocational factors, by making satellites of score variables related to weaker factors, may weaken the appearance of the latter even to the point at which they vanish from the solution. It is unlikely that a precision factor exists only in the airman population, or that qualities of precision (liking for exactness and detail) belong only with vocational factors in the officer group. It would be an interesting study to repeat the extraction of factors with all of the vocational-reference scores eliminated from the correlation matrix.

In reference to the nonvocational factors, the question arises as to how many of them are actually interest factors and how many should more properly be regarded as temperament factors. The boundary lines between modalities of personality variables are admittedly thin in many places. The distinctions are a matter of definition, and no definition establishes sharp boundaries. If we follow the definition given early in this report, which equates interest with a generalized behavior tendency to be attracted to a certain class of incentives or activities, most of the factors reported in this study can be regarded as interest variables. So long as the factor implies an urge to indulge in a certain class of activities or to achieve a certain kind of end result, the factor can be regarded as an interest. This criterion of interest would enable us to include probably all except two factors as interests, the two being self-reliance vs. dependence and expressiveness vs. restraint. These factors have to do with qualities of behavior without reference to particular incentives or goals and have more to do with the manner in which behavior runs its course.

If we took a more parsimonious view of interests, however, we might find that only a few of the more obviously goal-directed factors fit the category, for example such factors as adventure vs. security, aesthetic appreciation, need for diversion, interest in thinking, cultural interest, sociability, physical fitness, interest, and need for precision. This view might add to the list of temperament traits such factors as cultural conformity, autistic thinking, resistance to restriction, aggression, orderliness vs. disorderliness, need for a sympathetic environment, ambition, and social initiative. There are other places at which to draw the line between interests and temperament variables.

POLARITY OF FACTORS

Some personality dimensions, such as aptitudes, are unipolar. Individuals vary in them from none of the quality to a large amount. Other personality dimensions, such as attitudes and most temperament traits, are bipolar. Individuals vary between opposite qualities through a neutral point. In one sense we should expect interest factors to be generally bipolar, for they belong to the general species of affective variables manifested in terms of likes and dislikes. Motivation involves both appetites and aversions. Incentives can be rejected as well as welcomed. There are some members of the population who dislike mechanical types of activities as well as members who like them. When we obtain scores based on expressions of liking or disliking activities in various mechanical areas, however, the intercorrelations are all positive. The result is that all such scores correlate positively with the mechanical-interest factor. There are no negative factor loadings among such scores, as we

would expect to find in a bipolar factor. The reason is that although liking and disliking the class of activities represent a bipolar psychological continuum, the obtained factor is unipolar statistically because of the limitation of the kind of item we can use. There are no kinds of activities that are opposite in kind to mechanical activities. It would require that kind of item to result in a bipolar variable in factor analysis. Thus the finding of unipolar dimensions among the vocational-interest factors, at least, is to be expected.

One interesting exception to this rule, which does not actually violate the explanation just given, was found in the analyses reported here. We found two significant negative loadings on the mechanical factor, in the score for Sedentariness and Cleanliness. The items of these tests did not present activities opposite to mechanical activities but pertained to conditions that are incompatible with some mechanical pursuits. It is very reasonable that those who like mechanical activities also tend to dislike inactive, rocking-chair living. Possibly the lover of mechanical pursuit does not like to get his hands and clothes dirty, but if a person has an urge to keep clean he cannot fully enjoy certain mechanical activities. This was the only instance in which any vocational-interest factor had significant negative loadings. Another possible instance might appear in connection with scientific interest if there were items referring to religious interests and attitudes in the battery. Lurie (23) found negative loadings for aesthetic interest scores in connection with a business (philistine) factor, but our results did not confirm this.

For other than vocational interests, it is often easy to think of urges toward op-

posite kinds of behavior. Among Murray's list of needs there are several such pairs of apparent opposites. There is need for attention and need for obscurity; there is need for conformity and need for nonconformity; and there is need for affiliation and need for rejection. Thus, one could state a number of qualities describing needs in opposite directions. If the oppositions are psychologically real and unitary, bipolar factors should be forthcoming under the right conditions. In connection with a number of our primary hypotheses we attempted to test for the existence of these oppositions. For example, in the adventure list were measures of desire for harm-avoidance and for monotony. In the diversion list there were measures of need for amusement, play, and romanticism on the positive side and for realism and no-nonsense on the negative side. Other pairings of apparent opposites were conformity vs. nonconformity, orderliness vs. disorderliness, system vs. aversion for system, and sensory appeals vs. sensory aversions.

Not all of these opportunities for bipolar factors were realized. One that did emerge is the factor of adventure vs. security, with the positive and negative qualities sorting as anticipated—liking for exploring, personal risk-taking, travel, and variety on the positive side and liking for monotony and the urge for harm-avoidance on the negative side. Another bipolar factor that was expected and that did emerge, but only in the officer analysis, was orderliness vs. disorderliness. On the positive side were no-nonsense, cleanliness, system, and persistence and on the negative side were liking for disorder and for risk-taking of material possessions.

Some obtained bipolar factors were not expected, as such, but arose by way

of drawing opposite qualities from what might have been anticipated to give separate unipolar factors. One example of this was the factor of expressiveness vs. restraint. On the positive side of the picture we find the qualities of carefreeness, recklessness, and exhibitionism (to paraphrase some of the test titles) and on the negative side we find persistence, dependability, timidity, and carefulness. Another example was the factor of self-reliance vs. dependence, which arose mainly from tests under the hypotheses of RESPONSIBILITY on the positive side and of SUPPORT on the negative side. This opposition might have been predicted.

Some of the opposite qualities, as hypothesized, did not determine bipolar factors. The score variables for Conformity and Nonconformity separated and two unipolar factors appeared. One was called cultural conformity and the other was called resistance to restriction. The former has a strong ethical aspect, with substantial loadings in Conscience Satisfaction, No-Nonsense, Carefulness, and Discipline (belief in). The latter factor can be described as a desire for freedom, without much ethical implication, as shown in dislike for laws, restraints, schedules, order and system. This is a striking example of how qualities believed by armchair analysis to be direct psychological opposites turn out by factor analysis not to be opposites at all.

There are interesting implications in the instance of this particular pair of factors. The result can mean that the same individual may have a strong urge to conform to social and cultural mores and yet may be a lover of freedom; in this sense we have a nonconforming conformist. At the other extreme, a person

may be unready to accept the social and cultural mores and yet cares little for freedom, a conforming nonconformist. There is thus a semantic difficulty involved. The apparent contradiction can be resolved in operational terms. In writing items to bring out individual differences in nonconformity, we apparently did not maintain a separation of 180 degrees to measures of conformity. While conformity and nonconformity still maintain opposite meanings, as labels to our two tests one or both are misleading. The result in connection with these factors does much to revise our thinking about what kind of opposition exists when any pair of bipolar trait names is employed.

INTERCORRELATIONS OF FACTORS

We stated earlier that we do not believe that an oblique rotation solution gives us an accurate picture of the correlations between first-order factors. In interpreting this statement it is necessary to keep in mind the distinction between factors as mathematical or statistical landmarks and factors as psychological unities. There can be little question about the facts of factor intercorrelation found by an oblique solution, when factors are regarded in the mathematical sense only. But when we turn our attention to the psychological dimensions that the mathematical factors are supposed to represent, we may well question whether the correlations between the reference axes state correctly the psychological facts.

We have no doubt that there are some genuine relationships among the psychological dimensions in the domain of interests. We should know what those correlations are if we are to have a clear and complete picture of the structure of this

domain. At present we can only make some guesses. From what was said in earlier paragraphs it may be concluded that there must be some positive relationships between mechanical and scientific interests and between both of these and the urge for precision. The urge for precision also enters into apparent relationship with the factor of clerical interest. Social welfare interest seems to bear a relationship to the factor of aggression, through their common expression in scores for liking to control or dominate others.

We must be on our guard, however, lest such apparent linkages be merely a function of a faulty test construction. For example, there appears to be some affiliation between the factor of interest in diversion and the factor of interest in thinking. The diversion factor had a substantial loading in a score for problem solving. Examination of the items in the problem-solving inventory, however, shows that the problems mentioned (because they are within the common experience of most people) frequently have to do with solving riddles and puzzles or with playing chess, checkers, or bridge. All of these come under the category of pastimes or games; all have diversion value. It would not take many such items in a total of 10 to induce a correlation between this inventory score and those having to do more completely and intentionally with diversion or amusement.

The apparent affiliation between the factor of aggression and the factor of urge for physical fitness may have been induced by the presence of such items as "You would like to put a group through its regular setting-up exercises," in the inventory called dominance. The apparent affiliation of the factor of interest in diversion with the factor of

physical fitness interest might be because of the presence of such items as "You like to watch athletic teams practice" in one of the DIVERSION tests. On the other hand, there might be a genuine connection between the diversion and physical fitness factors. We do not have enough information to decide the matter.

These findings are a clear warning that one cannot be too careful in framing inventory items. It sometimes appears that a single word may be the key to the kind of discrimination obtained from an item and that that discrimination may be different from the one intended. Take for example the item "You would like to hunt elk in Wyoming." It contains three key words: "hunt," "elk," and "Wyoming," each of which may arouse its own affective reaction in the examinee. As a total unit, the item might have been intended to discriminate on the continuum of masculinity vs. femininity or on the dimension of adventure vs. security. However that may be, there are those who like to hunt but they do not like to hunt elk; and if they do like to hunt elk, they do not like to hunt in Wyoming. In other words, in addition to any total impression that a proposition makes on an examinee, the human brain, being an analyzer, reacts to parts of the stimulating pattern, each of which tends to set up its own chain reactions. If we want to establish the degree to which a person likes hunting as a class activity, we will need several items in which hunting is the common element and the type of game and the place are randomized from item to item. The logic of good experimental design is very much needed in the writing of test items.

When we know what the factors are,

the task of keeping variance in factor B out of an inventory which we are preparing to measure factor A is much easier. We have open to us the possibility of using the technique of negative item analysis. In negative item analysis we correlate items with a score for a factor that we want to keep out of a test. We then select items that have not only the highest correlations with a score for the factor that we want them to measure but also items that correlate low with other factors. If in spite of such efforts factor scores insist upon showing relationships, we are compelled to conclude that the factors are correlated. Without such tests, however, we cannot be sure when the correlations of factors are only apparent and when they are real.

The inadvertent presence of extra factor variances in tests also calls for care in the interpretation of results of factor analysis. It is often important to consider the test's content at the item level in order to arrive at the most enlightened interpretations of factors. This procedure sometimes makes possible the explanation of factor loadings that are otherwise unintelligible or unreasonable. Factor analysis has taught us to distrust names of tests and to look beneath test names when interpreting scores. We should also discount test names and scrutinize test content when we interpret factor loadings.

FACTORS IN CURRENT INTEREST INVENTORIES

Users of current interest inventories should be interested in the relation of factors to scoring categories of those inventories. This question pertains more readily to inventories that attempt to derive scores for basic or broad interest categories. We should not expect the

score variables for the Strong Vocational Interest Blank to coincide with factors, since those score categories were aimed at specific occupational syndromes. The implication of factorial findings for the Strong inventories is merely that a smaller number of score variables will cover economically the domain of vocational interest.

In the development of inventories that are aimed at basic variables, the use of factor analysis information has not heretofore played much part. To some extent this is because factorial information in this area has been somewhat limited, but probably it has been due more to the distrust of factorial information and a preference for other sources of information. If factors are valid dimensions of interests, however, the categories derived from other sources should eventually coincide with those from factor analysis. The categories derived from one source may be used as criteria for validation of those derived from other sources.

The Allport-Vernon *Study of Values* is scored for the six Spranger value types, as is well known. Of these, three probably correspond fairly well to interest factors found in this study—the theoretical value with the scientific factor, the economic value with the business factor, and the social value with the social welfare factor. In place of the aesthetic value we find two aesthetic factors, in line with at least two earlier studies (9, 23)—an aesthetic appreciation factor and an aesthetic expression factor. In other words, there is an interest for the producer of art distinct from that for the consumer of art. It is common sense that many individuals have a high degree of aesthetic appreciation without much urge to express themselves in aesthetic forms. It cannot be said with much confidence, however, that there are individuals with a strong urge to express themselves artistically who lack aesthetic appreciation. The relationship between these two factors is undoubtedly real, but it is likely to be a one-way affair, with a curvilinear relationship between the two.

As to the other Allport-Vernon variables, the political value might be aligned with the factor of aggression, but it is probably broader than

that. We found no factor of religion in our results for the good reason that we avoided the inclusion of items bearing on that subject. Other investigators have found evidence for a religious factor; perhaps there is more than one. We can say of the Allport-Vernon variables, then, that they have the support of factorial findings, but they do not make enough discriminations and they do not cover as much of the domain of motivation as they could.

Of the Kuder list of nine interest categories, from his Preference Record, three correspond clearly with interest factors—mechanical, scientific, and social service. Our analysis finds no basis for the discriminations that Kuder makes among artistic, literary, and musical interests. The variables we incorporated to explore the aesthetic area were very inclusive. There were scores for appreciation in the fields of drama, graphic arts, music, and writing, as well as for expression in each of these fields. In addition there was a score for appreciation of nature, and there were scores for the appreciation and the expression of humor, and two scores for verbal expression. Any of these scores could possibly enter the aesthetic orbit.

We found two aesthetic factors, as was stated before. Both were substantially related to scores in all four fields—music, literature, drama, and the graphic arts. Appreciation of nature did not come into the list of appreciation measures as we had fully anticipated. Instead, it tended to follow the score for interest in travel, which went into the adventure category. Perhaps the items did not stress the beauty aspects of nature sufficiently. The score for expression of humor went into the aesthetic expression list for the officer analysis but not for the airman analysis. The two verbal expression scores went into the aesthetic expression list with barely significant loadings. They may have acquired their relationship to this factor because of the presence of a literary expression score, which has much higher loading in the aesthetic expression factor. As was remarked before, the correlation between these verbal tests was not sufficient to split off a verbal-interest factor. A fair conclusion concerning the Kuder categories in the aesthetic area would be that his three scores—artistic, literary, and music—are aimed at rather specific discriminations. He is able to obtain near-zero correlations among these three scores by utilizing the forced-choice type of item. In our results there are very substantial positive correlations among such measured interests when the items are not of the forced-choice type.

Kuder's scores for computational and clerical interests may also be at the specific level, or

they may not. In our analysis the two scores did not separate in two factor lists, possibly because we did not have enough supporting scores for both. It is difficult to write two computational-interest tests that have enough disparity of content to avoid the danger of specific overlap. The same is true of two clerical-interest tests. When scores for clerical and numerical activities of the nonforced-choice type are correlated, the coefficient is likely to be high, thus making factorial separation difficult. It is possible that in practice the discrimination between numerical and clerical interests is worth making. The amount of apparent independence as indicated by the correlation of the Kuder scores, however, is highly misleading.

The Guilford-Shneiderman-Zimmerman Interest Survey is scored for nine major categories, with a two-fold discrimination of some kind made in each. Eight of the nine major categories correspond well with obtained factors. The artistic and linguistic scores should not have been separated, but the distinction made between appreciation and expression in the aesthetic areas should be maintained. In terms of factors there is little to support the two-fold distinctions made within other major categories—investigatory vs. theoretical interests in science, manipulative vs. designing interests under mechanical, and the personal service vs. social welfare interests under personal assistance. Although the original list of 18 score categories was based largely upon the factor analysis information then available, there is room for improvement in the light of new information.

Possibly factorial information is still not sufficient to justify the fashioning of an inventory for practical use on factor categories alone. There may also be good reasons for making a few more specific discriminations, as Kuder does. One thing seems certain, however: no presently available inventory of basic-interest score categories gives sufficient coverage of the interest domain, when the interest domain includes all the human urges to activities that have vocational implications. It also seems to us that in the long run factorial concepts will prove most useful and economical in the measurement of interests.

V. SUMMARY AND CONCLUSIONS

1. Thirty-three primary hypotheses were developed regarding the nature of the primary interests. One hundred subsidiary hypotheses were formulated for which to build tests.

2. For each subsidiary hypothesis, representative homogeneous 10-item tests were prepared after much item construction, pretesting, and revision. The factor analysis interest inventory contained 1,000 items representing the 33 primary hypotheses including the 100 subsidiary hypotheses.

3. The inventory was administered to four samples of Air Force personnel, including 600 airmen, 276 officer candidates, 257 AFROTC, and 187 air cadets.

4. Scores for the three latter samples were combined and intercorrelated for use in an officer-level factor analysis. Scores for the airmen sample were intercorrelated and used in an airman factor analysis.

5. Ninety-five of the 100 score variables were factor analyzed. Twenty-four centroid factors were extracted from the airman correlation matrix and 23 factors from the officer matrix.

6. Graphic, orthogonal rotations of the reference axes for the two analyses were carried out independently by two investigators.

7. Seventeen factors were identified as the same across the two analyses. Six interpretable factors were unique to the airman analysis and five were unique to the officer analysis.

8. Of the 19 hypothesized factors for which at least three tests were analyzed, 14 were verified by the results, with a fifteenth being bipolar with one of the 14. Of nine hypothesized factors for which there were two tests each, four were verified. One hypothesis had no

chance of verification because the two tests for it intercorrelated very low, even with one another. Of the four hypotheses for which there was only one test each, one was verified.

9. Of the 28 interpretable factors from the two analyses, six, and possibly seven, can be regarded as definitely directed toward vocational stereotypes or occupational classes. Under a broad definition of interests, 19 additional factors may be regarded as basic interest factors, some of which have vocational implications of a very broad nature. Thus, the vocational factors that have been found in other studies by factor analysis do not disperse among more basic factors when the analysis is very comprehensive. The structure of the domain of interests, therefore, seems to include a limited number of vocationally oriented variables superimposed upon or differentiated from a broader base of general interest variables that have nonvocational implications as well.

10. While interest variables are bipolar, since there are aversions as well as attractions, factor analysis procedures may result in bipolar interest factors or they may not, depending upon the type of test material used. Most factors were statistically unipolar. With appropriate test material, factor analysis provides interesting checks on psychological qualities believed to be opposites.

11. There are probably a number of nonzero correlations among the interest factors. It was pointed out, however, that while oblique-rotation methods provide a way of determining intercorrelations of statistical factors, there is as yet no good procedure for determining the amount of correlation between psychological factors.

12. The correspondence between scoring categories of current interest inventories in use and interest factors leaves much to be desired, though there is

some indication of growing use of factorial concepts in the choice of test variables.

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